U.S. DEPARTMENT OF COMMERCE PATENT & TRADEMARK OFFICE

B/O Form PTO-1390 **Transmittal Letter to the United States Designated/Elected Office (DO/EO/US) Concerning a Filing Under *35 USC 371***		*Attorney's Docket Number* GRAS3004/JEK *U.S. Application Number (if known)* 09/926447
International Application Number PCT/EP00/03988	*International Filing Date* 04 May 2000	*Priority Date Claimed* 07 May 1999
Title of Invention METHOD FOR HANDLING THINNED CHIPS FOR INTRODUCING THEM INTO CHIP CARDS		
Applicant(s) for DO/EO/US Thomas GRASSL et al.	Assignee	

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items under *35 USC 371*:

1. ☒ This is a **FIRST** submission of items concerning a filing under *35 USC 371*.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under *35 USC 371*.
3. ☒ This express request to begin national examination procedures *(35 USC 371(f))* at any time rather than delay examination until the expiration of the applicable time limit set in *35 USC 371(b)* and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed *35 USC 371(c)(2)*.
   a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☒ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English *(35 USC 371(c)(2))*.
7. ☒ Amendments to the claims of the International Application under PCT Article 19 *(35 USC 371(c)(3))*
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 *(35 USC 371(c)(3))*.
9. ☒ An oath or declaration of the inventor(s) *(35 USC 371(c)(4))*. (☐ Executed ☒ Unexecuted)
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 *(35 USC 371(c)(5))*.

Items 11 to 16 below concern other document(s) or information included:

11. ☐ An Information Disclosure Statement under *37 CFR 1.97* and *1.98*.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with *37 CFR 3.28* and *3.31* is included.
13. ☒ A **FIRST** preliminary amendment.
    ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information: 5 sheets formal drawings

Application Number (if Known) 09/926447	*International Application Number* PCT/EP00/03988	*Attorney's Docket Number* GRAS3004/JEK

	Calculations	PTO USE ONLY
17. The following fees are submitted: **Basic National Fee** *(37 CFR 1.492(a)(1)-(5))*: ☒ Search report has been prepared by the EPO or JPO . . . . . $890.00 ☐ International Preliminary Examination Fee paid to USPTO *(37 CFR 1.482)* . . . . . $710.00 ☐ No International Preliminary Examination Fee paid to USPTO *(37 CFR 1.482)* but International Search Fee paid to USPTO *(37 CFR 1.445(a)(2))* . . . . . $740.00 ☐ Neither International Preliminary Examination Fee *(37 CFR 1.482)* nor International Search Fee *(37 CFR 1.445(a)(2))* paid to USPTO . . . . . $1040.00 ☐ International Preliminary Examination Fee paid to USPTO *(37 CFR 1.482)* and all claims satisfied provisions of PCT Article 33(1)-(4) $100.00		
ENTER APPROPRIATE BASIC FEE AMOUNT	**$ 890.00**	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date *(37 CFR 1.492(e))*.		

CLAIMS	NUMBER FILED		NUMBER EXTRA	RATE		
Total Claims	45	-20 =	25	× $18.00	$ 450.00	
Independent Claims	5	-3 =	2	× $84.00	$ 168.00	
Multiple Dependent Claims (if applicable)				+ $280.00	$ 280.00	
TOTAL OF ABOVE CALCULATIONS					**$ 1,788.00**	
Reduction by ½ for filing by small entity, if applicable. Small Entity Status is asserted pursuant to 37 CFR 1.27 for this application.						
SUBTOTAL					**$ 1,788.00**	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date *(37 CFR 1.492(f))*.						
TOTAL NATIONAL FEE					**$ 1,788.00**	
Fee for recording the enclosed assignment *(37 CFR 1.21(h))*. The assignment must be accompanied by an appropriate cover sheet *(37 CFR 3.28, 3.31)*. **$40.00** per property.						
TOTAL FEES ENCLOSED					**$ 1,788.00**	
Amount to be: Refunded:						
Charged:						

a. ☒ A check in the amount of **$1,788.00** to cover the fees is enclosed.

b. ☐ Please charge my **Deposit Account Number 02-0200** in the amount of $_____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to **Deposit Account Number 02-0200**. A duplicate copy of this sheet is enclosed.

Note: Where an appropriate time limit under *37 CFR 1.494* or *1.495* has not been met, a petition to revive *(37 CFR 1.137(a) or (b))* must be filed and granted to restore the application to pending status.

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DATE: 06 November 2001

Respectfully submitted,

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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

International Patent Application No. PCT/EP00/03988

PCT/DO/EO/US

International Filing Date: 04 May 2000

Attorney Docket: GRAS3004/JEK

Applicant: Thomas GRASSL et al.

For: METHOD FOR HANDLING THINNED CHIPS FOR INTRODUCING THEM INTO CHIP CARDS

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

Sir:

This paper accompanies documents to establish the U.S. national stage of the above-identified international patent application under 35 U.S.C. §371. The claims were not amended during international processing.

Before calculation of the filing fee and before examination, please amend the application as follows:

IN THE CLAIMS:

Please amend the original as-filed claims as shown on the appended APPENDIX OF CLAIMS, which includes amended and non-amended claims. Also appended hereto an APPENDIX OF MARKED UP CLAIMS showing the changes which have been made.

REMARKS

The amendments are intended to remove informalities and it is not intended to narrow any elements of the claims by the proposed amendments.

International Application No. PCT/EP00/03988
Attorney Docket: GRAS3004/JEK

All rights are reserved to the original claimed subject matter. The claims have been amended to reduce the filing fees and to better conform to U.S. claim format. Examination of the application as amended is respectfully requested.

Respectfully submitted,
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Date: November 5, 2001

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International Application No. PCT/EP00/03988
Attorney Docket: GRAS3004/JEK

APPENDIX OF CLAIMS

1(Amended). A method for handling thinned chips for incorporation in smart cards comprising the following steps:

gluing a wafer with its front side to a carrier substrate by means of an adhesive layer,

thinning the wafer from the backside,

dividing the wafer into individual chips by sawing the wafer from the backside up to or into the adhesive layer or into the carrier substrate,

dissolving the adhesive layer,

lifting the individual chips off the carrier substrate with a suction head for deposit in a special tray and/or for further processing.

2(Amended). A method for handling thinned chips for incorporation in smart cards comprising the following steps:

gluing a wafer with its front side to a carrier substrate by means of an adhesive layer,

thinning the wafer from the backside,

dividing the wafer into individual chips by sawing the wafer from the backside up to or into the adhesive layer or into the carrier substrate,

gluing the chips sawed out of the wafer on their backsides with a continuous carrier film by means of a second adhesive layer,

dissolving the first adhesive layer using a process which does not attack the second adhesive layer,

lifting the chips joined by the carrier film off the carrier substrate together with the carrier film,

dissolving the second adhesive layer and lifting the individual chips off the carrier film.

3(Amended). A method for handling thinned chips for incorporation in smart cards comprising the following steps:

gluing a wafer with its front side to a carrier substrate by means of an adhesive layer,

thinning the wafer from the backside,

gluing the wafer on the backside with a continuous carrier film by means of a second adhesive layer,

dividing the wafer into individual chips by sawing the wafer with the glued-on carrier film from the backside of the wafer up to or into the first adhesive layer or into the carrier substrate,

dissolving the first adhesive layer using a process which does not attack the second adhesive layer,

lifting the individual chips off the carrier substrate together with the carrier film.

4(Amended). The method according to either of claims 2 and 3, wherein the first adhesive layer comprises an adhesive which is decomposed under the action of light of a certain wave range, and the second adhesive layer comprises an adhesive which cures under the action of said light.

5(Amended). The method according to either of claims 2 and 3, wherein the first adhesive layer comprises an adhesive which is decomposed under the action of heat, and the second adhesive layer comprises an adhesive which cures under the action of heat.

6(Amended). The method according to either of claims 2 and 3, wherein the first adhesive layer comprises a water-soluble adhesive and/or the second adhesive layer comprises an adhesive which is solvent-resistant.

7(Amended). The method according to either of claims 2 and 3, wherein the first adhesive layer comprises an adhesive which is decomposed under an oxygen plasma or in a certain gas environment, and the second adhesive layer comprises an adhesive which is resistant to said conditions.

8(Amended). The method according to either of claims 1 or 2, wherein the carrier substrate is dissolved together with the adhesive layer between the wafer and the carrier substrate and/or instead of said adhesive layer.

9(Amended). The method according to claim 8, wherein the carrier substrate comprises a material which decomposes in a plasma and/or under the action of gas and/or under elevated temperature and/or is water-soluble.

10(Amended). The method according to claim 1, including applying position marks to the backside of either or both the chips and the carrier film.

11(Amended). The method according to claim 1, including applying the chips with their front sides to a first smart card foil provided with conductive paths.

12(Amended). The method according to claim 1, including applying the chips with their backsides to a first smart card foil and providing the chips and foil with conductive paths.

13(Amended). The method according to claim 11 or 12, including providing the first smart card foil on the surface opposite the chip with contact areas connected with the chip via the conductive paths, and the thus constructed chip module is incorporated with the contact areas outside into a cavity of a smart card.

14(Amended). The method according to claim 11 or 12, including covering the first smart card foil with the chip with a second smart card foil and laminating the two smart card foils together.

15(Amended). The method according to claim 14, including pretreating the first smart card foil so that the chip adheres to the first smart card foil until it is covered with the second smart card foil.

16(Amended). The method according to claim 15, including printing the first smart card foil with an adhesive conductive paste so that the chip adheres to the first smart card foil until it is covered with the second smart card foil, and is electrically contacted at the same time.

17(Amended). The method according to claim 1, including applying the chips with their backsides to a first smart card foil and covering the first smart card foil with the chip with a second smart card foil provided with conductive paths at the corresponding positions, and laminating the two smart card foils together.

18(Amended). A method for incorporating a thinned chip into a smart card, comprising applying the chip to a surface of the smart card externally.

19(Amended). The method according to claim 18, including applying the chip with its front side pointing outside to the surface of the smart card and wherein the card and chip are provided with conductive paths.

20(Amended). The method according to claim 18 or 19, including incorporating the chip into a cavity in the surface of the smart card.

21(Amended). The method according to claim 18, including pressing the chip into the surface of the smart card flush under the action of heat.

22(Amended). The method according to claim 18, including coating the chip located on the surface of the smart card with a protective lacquer.

23(Amended). The method according to claim 11, including applying the conductive paths by means of a printing or embossing method.

24(Amended). The method according to claim 2 including lifting the chip off the carrier film and mounting the chip on the smart card foil or the surface of the smart card.

25(Amended). The method according to claim 24, including gluing the chip onto the card foil by means of the adhesive of the dissolved second adhesive layer.

26(Amended). The method according to claim 25, wherein the chip is lifted off the carrier foil with a suction head and applied to the card foil, the second adhesive layer being dissolved under the action of heat.

27(Amended). A smart card comprising a smart card having at least one thinned chip disposed on a surface of the smart card.

28(Amended). The smart card according to claim 27, wherein the chip is disposed with its front side outside on the smart card and conductive paths are applied to the smart card and the chip on the outside.

29(Amended). The smart card according to claim 27 or 28, wherein the conductive paths are printed.

30(Amended). The smart card according to claim 27 or 28, wherein the chip is disposed in a cavity in the surface of the smart card.

31(Amended). The smart card according to claim 27, wherein the chip is pressed into the surface of the smart card flush.

32(Amended). The smart card according to claim 27, wherein the chip is coated with a protective lacquer.

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International Application No. PCT/EP00/03988
Attorney Docket: GRAS3004/JEK

APPENDIX OF MARKED UP VERSION OF CLAIMS

1(Amended). A method for handling thinned chips [(10)] for incorporation in smart cards [(20)] comprising the following [method] steps:

[-] gluing a wafer [(1)] with its front side to a carrier substrate [(4)] by means of an adhesive layer [(3)],

[-] thinning the wafer [(1)] from the backside,

[-] dividing the wafer [(1)] into individual chips [(10)] by sawing the wafer [(1)] from the backside up to or into the adhesive layer [(3)] or into the carrier substrate [(4)],

[-] dissolving the adhesive layer [(3)],

[-] lifting the individual chips [(10)] off the carrier substrate [(4)] with a suction head [(30)] for deposit in a special tray [(40)] and/or for further processing.

2(Amended). A method for handling thinned chips [(10)] for incorporation in smart cards [(20)] comprising the following [method] steps:

[-] gluing a wafer [(1)] with its front side to a carrier substrate [(4)] by means of an adhesive layer [(3)],

[-] thinning the wafer [(1)] from the backside,

[-] dividing the wafer [(1)] into individual chips [(10)] by sawing the wafer [(1)] from the backside up to or into the adhesive layer [(3)] or into the carrier substrate [(4)],

[-] gluing the chips [(10)] sawed out of the wafer [(1)] on their backsides with a continuous carrier film [(5)] by means of a second adhesive layer [(6)],

[-] dissolving the first adhesive layer [(3) with a method] <u>using a process</u> which does not attack the second adhesive layer [(6)],

[-] lifting the chips [(10)] joined by the carrier film [(5)] off the carrier substrate [(4)] together with the carrier film [(5)],

[-] dissolving the second adhesive layer [(6)] and lifting the individual chips [(10)] off the carrier film [(5)].

3(Amended). A method for handling thinned chips [(10)] for incorporation in smart cards [(20)] comprising the following [method] steps:

[-] gluing a wafer [(1)] with its front side to a carrier substrate [(4)] by means of an adhesive layer [(3)],

[-] thinning the wafer [(1)] from the backside,

[-] gluing the wafer [(1)] on the backside with a continuous carrier film [(5)] by means of a second adhesive layer [(6)],

[-] dividing the wafer [(1)] into individual chips [(10)] by sawing the wafer [(1)] with the glued-on carrier film [(5)] from the backside of the wafer [(1)] up to or into the first adhesive layer [(3)] or into the carrier substrate [(4)],

[-] dissolving the first adhesive layer [(3) with a method] using a process which does not attack the second adhesive layer [(6)],

[-] lifting the individual chips [(10)] off the carrier substrate [(4)] together with the carrier film [(5)].

4(Amended). [A] The method according to either of claims 2 and 3, [characterized in that] wherein the first adhesive layer [(3) consists of] comprises an adhesive which is decomposed under the action of light of a certain wave range, and the second adhesive layer [(6) consists] comprises [of] an adhesive which cures under the action of said light.

5(Amended). [A] The method according to either of claims 2 and 3, [characterised in that] wherein the first adhesive layer [(3) consists of] comprises an adhesive which is decomposed under the action of heat, and the second adhesive layer [(6) consists of] comprises an adhesive which cures under the action of heat.

6(Amended). [A] The method according to either of claims 2 and 3, [characterized in that] wherein the first adhesive layer [(3) consists of] comprises a water-soluble adhesive and/or the second adhesive layer [(6) consists of] comprises an adhesive which is solvent-resistant.

7(Amended). [A] The method according to either of claims 2 and 3, [characterized in that] wherein the first adhesive layer [(3) consists of] comprises an adhesive which is decomposed under an oxygen plasma or in a certain gas environment, and the second adhesive layer [(6) consists of] comprises an adhesive which is resistant to said conditions.

8(Amended). [A] The method according to [any] either of claims 1 [to 7, characterized in that] or 2, wherein the carrier substrate [(4)] is dissolved together with the adhesive layer [(3)] between the wafer [(1)] and the carrier substrate [(4)] and/or instead of said adhesive layer [(3)].

9(Amended). [A] The method according to claim 8, [characterized in that] wherein the carrier substrate [(4) consists of] comprises a material which decomposes in a plasma and/or under the action of gas and/or under elevated temperature and/or is water-soluble.

10(Amended). [A] The method according to [any of claims 1 to 9, characterized in that] claim 1, including applying position marks [(8) are applied] to the backside of either or both the chips [(10) and/or of] and the carrier film [(5)].

11(Amended). [A] The method according to [any of claims 1 to 10, characterized in that] claim 1, including applying the chips [(10) are applied] with their front sides to a first smart card foil [(21)] provided with conductive paths [(11)].

12(Amended). [A] The method according to [any of claims 1 to 10, characterized in that] claim 1, including applying the chips [(10) are applied] with their backsides to a first smart card foil [(21)] and providing the chips and foil [contacted] with conductive paths [(11)].

13(Amended). [A] The method according to claim 11 or 12, [characterized in that] including providing the first smart card foil [(21) is provided] on the surface opposite the chip [(10)] with contact areas [(23)] connected with the chip [(10)] via the conductive paths [(11)], and the thus constructed chip module is incorporated with the contact areas [(23)] outside into a cavity [(24)] of a smart card [(20)].

14(Amended). [A] The method according to claim 11 or 12, [characterized in that] including covering the first smart card foil [(21)] with the chip [(10) is covered] with a second smart card foil [(22)] and laminating the two smart card foils [(21, 22) are laminated] together.

15(Amended). [A] The method according to claim 14, [characterized in that] including pretreating the first smart card foil [(21) is pretreated] so that the chip [(10)] adheres to the first smart card foil [(21)] until it is covered with the second smart card foil [(22)].

16(Amended). [A] The method according to claim 15, [characterized in that] including printing the first smart card foil [(21) is printed] with an adhesive conductive paste so that the chip [(10)] adheres to the first smart card foil [(21)] until it is covered with the second smart card foil [(22)], and is electrically contacted at the same time.

17(Amended). [A] The method according to [any of claims 1 to 10, characterized in that] claim 1, including applying the chips [(10) are applied] with their backsides to a first smart card foil [(21)] and covering the first smart card foil [(21)]

with the chip [(10) is covered] with a second smart card foil [(22)] provided with conductive paths [(11)] at the corresponding positions, and laminating the two smart card foils [(21, 22) are laminated] together.

18(Amended). A method for incorporating a thinned chip [(10)] into a smart card [(20), in particular according to any of claims 1 to 10, characterized in that] , comprising applying the chip [(10) is applied] to a surface of the smart card [(20)] externally.

19(Amended). [A] The method according to claim 18, [characterized in that the chip (10) is applied] including applying the chip with its front side pointing outside to the surface of the smart card [(20)] and wherein the card and chip are provided with conductive paths [(11)].

20(Amended). [A] The method according to claim 18 or 19, [characterized in that] including incorporating the chip [(10) is incorporated] into a cavity [(27)] in the surface of the smart card [(20)].

21(Amended). [A] The method according to [any of claims 18 to 20, characterized in that] claim 18, including pressing the chip [(10) is pressed] into the surface of the smart card [(20)] flush under the action of heat.

22(Amended). [A] The method according to [any of claims 18 to 21, characterized in that] claim 18, including coating the chip [(10)] located on the surface of the smart card [(20) is coated] with a protective lacquer [(12)].

23(Amended). [A] The method according to [any of claims 11 to 22, characterized in that] claim 11, including applying the conductive paths [(11) are applied] by means of a printing or embossing method.

24(Amended). [A] The method according to claim 2 [and any of claims 12 to 23, characterized in that] including lifting the chip [(10) is lifted] off the carrier film [(5)] and [mounted] mounting the chip on the smart card foil [(21)] or the surface of the smart card [(20)].

25(Amended). [A] The method according to claim 24, [characterized in that the chip (10) is glued] including gluing the chip onto the card foil [(20)] by means of the adhesive of the dissolved second adhesive layer [(6)].

26(Amended). [A] The method according to claim 25, [characterized in that] wherein the chip [(10)] is lifted off the carrier foil [(5)] with a suction head [(30)] and applied to the card foil [(20)], the second adhesive layer [(6)] being dissolved under the action of heat.

27(Amended). A smart card [(20) with] comprising a smart card having at least one thinned chip [(10) which is] disposed on a surface of the smart card [(20)].

28(Amended). [A] The smart card according to claim 27, [characterized in that] wherein the chip [(10)] is disposed with its front side outside on the smart card [(20)] and conductive paths [(11)] are applied to the smart card [(20)] and the chip [(10)] on the outside.

29(Amended). [A] The smart card according to claim 27 or 28, [characterized in that] wherein the conductive paths [(11)] are printed.

30(Amended). [A] The smart card according to [any of claims 27 to 29, characterized in that] claim 27 or 28, wherein the chip [(10)] is disposed in a cavity [(27)] in the surface of the smart card [(20)].

31(Amended). [A] The smart card according to [any of claims 27 to 30, characterized in that] claim 27, wherein the chip [(10)] is pressed into the surface of the smart card [(20)] flush.

32(Amended). [A] The smart card according to [any of claims 27 to 31, characterized in that] claim 27, wherein the chip [(10)] is coated with a protective lacquer [(12)].

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A method for handling thinned chips for incorporation in smart cards

The present invention relates to a method for handling thinned chips for incorporation in smart cards.

Thinned chips have been used for some time for producing vertically integrated circuit structures (VIC).

DE 44 33 846 A1 describes the production of such a VIC wherein a wafer, here a so-called top substrate, is first glued with its front side, i.e. the active or functional IC area where the component layers are located, to a so-called handling substrate by means of an adhesive layer and then thinned from the backside. Thinning is done e.g. by wet-chemical etching or by mechanical or chemomechanical grinding. Such a top substrate is then provided with an adhesive layer, mounted on a so-called bottom substrate in exactly adjusted fashion and connected thereto. The handling substrate is then removed.

EP 0 531 723 B discloses a similar method wherein a first circuit component is fastened with its active area to a carrier and then thinned from the backside. Then another circuit component is mounted on the backside of the thinned chip and connected thereto by means of contact pads previously produced on the backside of the thinned chip. Then the mounted circuit component is likewise thinned from the backside, provided with contact pads and another circuit component mounted. This step is repeated several times until the desired multi-element package is finally built up from superimposed components.

All such methods describe only the handling of the chips in a method stage in which they are either not yet thinned or already built up into a stable package. No methods are provided for handling individual thinned chips to incorporate them into smart cards. This is in particular not possible with the methods and tools hitherto used in smart card production. However, the use of thinned chips is desirable due to their particular flexibility in smart cards, which are often highly stressed by bending and torsion.

The invention is therefore based on the problem of providing a method for individually handling thinned chips and incorporating them in smart cards.

This problem is solved by a method according to claims 1, 2 or 3.

The starting point in each case is that a wafer is first glued with its front side, where the components are located, to a carrier substrate by means of an adhesive layer. The wafer is then thinned from the backside. After thinning, the wafer is divided into individual chips by sawing into the wafer from the backside. Sawing can be done up to or into the adhesive layer or even into the carrier substrate.

There are various ways of lifting the chips off the carrier substrate and singling them according to the invention.

According to claim 1, the adhesive layer is dissolved and the individual chips lifted off the carrier substrate with a suction head. They are then preferably deposited in a special tray for further processing. In this method the chips lie in the special trays with their backsides upward. Alternatively, the chips can of course also be processed immediately, for example immediately mounted on a smart card or smart card foil.

Claim 2 provides according to the invention a further method step wherein the individual chips still located on the carrier substrate are glued on the backside with a continuous carrier film by means of a second adhesive layer after sawing. The first adhesive layer is then dissolved with a method which retains the second adhesive layer. The chips can then be lifted off the carrier substrate together, joined by the carrier film. It is then possible to remove the individual chips from the carrier film by dissolving the second adhesive layer. Removal can also be done with the aid of a suction head or the like here. In this method the active front side of the chip is then on top.

According to claim 3 it is provided according to the invention that said carrier film is glued on directly after thinning of the wafer and the wafer saw-diced into individual chips only then. The film remains on the individual chip upon incorporation in the smart card; the chip is thus reinforced by the carrier film and can also be handled by conventional methods and tools. The use of suitable, e.g. viscoplastic, materials for the carrier foil permits the latter to be kept relatively thin while ensuring sufficient stability of the chip-foil compound.

The chips can of course be temporarily stored in a tray in the course of further processing in the latter two methods as well.

There are different ways of dissolving the first adhesive layer while simultaneously retaining the second adhesive layer, each depending on the properties of the kinds of adhesive used. Preferred methods are described in the subclaims.

Alternatively, it is fundamentally also possible for the carrier substrate itself to be dissolved together with the adhesive layer between wafer and carrier substrate, or instead of said adhesive layer. It goes without saying that a method is chosen for this purpose which does not attack the second adhesive layer in the methods according to claim 2 or 3.

The thinner chips that can be handled safely and easily with the inventive methods are more flexible and require less space than conventional chips. This opens up new possibilities for accommodating chips in smart cards.

A distinction must first be made here between methods by which chips are mounted with their front sides on a smart card foil e.g. already provided with conductive paths or on the smart card (flip-chip technique), and methods by which chips are mounted with their backsides on the smart card foil or smart card and the conductive paths then connected to the chip. Which method is more favorable depends on, among other things, which of the aforementioned methods for removing the thinned chips from the carrier substrate is used, i.e. in which direction the chips are already oriented.

In methods by which chips must be handled from the backside, it is advantageous if position marks are applied to the backside of the chips or to the carrier film. Such markings permit exact alignment of the chip on the smart card. A recommendable position marking is to replicate the circuit structure of the chip.

One incorporation method is to apply the chip to a smart card foil provided on the backside opposite the chip with contact areas which are in turn connected with the chip via conductive paths through the foil. This thus constructed chip module can then be incorporated into a cavity of a smart card with the contact areas outside, as is also the case with conventional structures of smart cards.

An alternative is to incorporate the chips between the foils when two smart card foils are laminated together.

In an especially preferred incorporation method the chip is simply applied to the surface of a smart card. The chip is preferably mounted with its front side pointing outside and the smart card together with the chip is then provided with conductive paths.

The conductive paths can be applied here by an embossing or printing method, preferably by screen printing. Due to the small dimensions of the thinned chip, the latter is hardly bulky on the surface of the smart card. It is of course also possible, however, to incorporate the chip in the surface of the smart card in a shallow cavity. It is advantageous to coat the chips exposed on the surface with a protective lacquer.

Such smart cards with an external thinned chip can be fabricated with considerably fewer method steps compared to conventional smart cards in which a conventional chip is accommodated in a special cavity in a chip module.

In all incorporation methods it is possible both to mount external contact areas on the smart card and to imprint coils or similar components so as to permit contactless data transmission from and to the smart card. A combined solution of both interfaces is likewise possible (dual interface).

The inventive methods will be described in more detail in the following by examples with reference to the enclosed schematic drawings, in which:

Fig. 1 shows a wafer connected on its active area with a carrier substrate by means of an adhesive layer,

Fig. 2a shows a wafer according to Fig. 1 after thinning and division into individual chips,

Fig. 2b shows two chips of the wafer according to Fig. 2a in a special tray,

Fig. 3a shows a thinned and sawed wafer with a carrier film,

Fig. 3b shows individual chips joined by the carrier film,

Fig. 4a shows a wafer fastened to a carrier substrate according to Fig. 1 and thinned before division into individual chips,

Fig. 4b shows a chip produced according to Fig. 4a on a smart card,

Fig. 5 shows a smart card with a chip module,

Fig. 6 shows a perspective view of a thinned chip with position markings,

Figs. 7 - 9 show variants of a smart card with a thinned chip applied to the surface and subsequent application of terminal areas,

Figs. 10/11 show production of a smart card by laminating two card foils together,

Figs. 12/13 show variants of a smart card with a thinned chip applied to the surface to terminal areas already present.

In carrying out the method, wafer 1 is first glued with its front side having components 2 to carrier substrate 4. The carrier substrate used can be e.g. another wafer, a metal foil or magnetizable foil or another kind of foil usual in smart card production such as PVC, ABS, PC or the like.

For this purpose adhesive layer 3 is applied either to wafer 1 or to carrier substrate 4 and the two parts are then joined.

The wafer contains in usual fashion several circuits disposed side by side that can each form a standard smart card chip or else a memory chip.

Wafer 1 fastened to carrier substrate 4 is then thinned from the backside up to a predetermined thickness, as shown in Fig. 1 by dashed line 9. Thinning can be done by conventional methods, for example etching or mechanical grinding. In this way it is possible to thin wafer 1 or chips 10 fabricated therefrom to a thickness of under 100 microns, preferably about 20 microns.

According to the method shown in Figs. 2a and 2b, saw cuts 7 are then made in wafer 1 from the backside up to adhesive layer 3, wafer 1 thus being subdivided into individual chips 10. Adhesive layer 3 is then dissolved or partially dissolved, chips 10 being lifted off carrier substrate 4 with suction head 30 and deposited in special trays 40 where they await further processing. Suction head 30 for removal of thin chips 10 is relatively flat and has several small holes 31 on the suction surface that can be subjected to suction air or compressed air as needed via a line for sucking or depositing chips 10. Chips 10 can be removed from special trays 40 in the same way and put in place with a robot during card production.

Dissolution of adhesive layer 3 of carrier substrate 4 can be done by the action of heat. For this purpose one uses e.g. heatable suction head 30 or separate heat radiation source 34, as in Fig. 4a.

Figs. 3a and 3b show an alternative method by which the active surface with components 2 of chips 10 ultimately lies on top. For this purpose, carrier film 5 is mounted on thinned and sawed wafer 1 by means of second adhesive layer 6. Said carrier film 5 can of course also be a self-adhesive foil already provided with an adhesive layer.

After application of carrier film 5 to the backside of wafer 1, first adhesive layer 3 is dissolved with a method which does not attack second adhesive layer 6.

There are different ways of doing this. In a first preferred method, first adhesive layer 3 consists of an adhesive which is decomposed under the action of light of a certain wave range, for example UV light, whereby second adhesive layer 6 just cures under said irradiation. In a second method, first adhesive layer 3 consists of an adhesive that decomposes under the action of heat whereby second adhesive layer 6 just cures under the action of heat. Alternatively, it is possible that first adhesive layer 3 consists of a water-soluble adhesive while second adhesive layer 6 is not water-soluble, or second adhesive layer 6 is solvent-resistant and first adhesive layer 3 dissolves with the corresponding solvent. Furthermore, it is possible that first adhesive layer 3 consists of an adhesive which is decomposed under an oxygen plasma or in a certain gas environment, e.g. ozone, whereby second adhesive layer 6 is resistant to said conditions.

Another way is to use a method by which carrier substrate 4 itself is dissolved together with adhesive layer 3 or instead of adhesive layer 3. Carrier substrate 4 can for this purpose consist of Styrofoam or another material which decomposes in a plasma or under the action of etching gas or under elevated temperature. Or carrier substrate 4 used is made of cardboard or similar material which is water-soluble.

After dissolution of first adhesive layer 3 or carrier substrate 4, the total compound of chips 10 joined by carrier film 5 can then be removed together, the active area of chips 10 pointing outside. Individual chips 10 can then be removed from carrier film 5 by dissolution of second adhesive layer 6.

Figs. 4a and 4b show a third possible method by which carrier film 5 of a preferably viscoplastic material, such as polycarbonate, polyamide, copper, aluminum, steel or the like, is first glued to the backside of wafer 1 by means of adhesive layer 6. Only then is wafer 1 divided into individual chips 10 by making saw cuts 7. Finally, individual chips 10 are removed again by dissolution of first adhesive layer 3 or carrier substrate 4, a method also being applied here which does not attack the adhesive bond with carrier film 5. The methods used here correspond to the aforementioned methods. Fig. 4a schematically shows how individual chip 10 is removed from carrier substrate 4 with suction head 30, adhesive layer 3 being dissolved by heat radiator 34 while second adhesive layer 6 simultaneously cures. In this method, carrier film 5 remains on the backside of individual thin chip 10.

Figures 5 to 10 show different variants of how thinned chips 10 can be accommodated in or on smart card 20.

Depending on the choice of production method according to Figures 2, 3 or 4, it is expedient to mount chips 10 with their front sides or their backsides on smart card 20 or smart card foil 21. If chip 10 is mounted with its front side on smart card 20 or smart card foil 21, it is useful to first mount conductive paths 11 for contacting chip 10 on card 20 or foil 21 and then position chip 10 thereon. For this purpose, chip 10 has on its backside position markings 8, as shown in Figure 6, which are for example printed or etched on chip 10 or carrier foil 5.

Figure 5 describes an example of incorporation similar to known incorporation methods of conventional chip modules. Chip 10 is first mounted on first smart card foil 21. On the opposite backside of smart card foil 21 there are contact areas 23 connected with chip 10 via conductive paths 11 through smart card foil 21 by means of conductive adhesive. Between chip 10 and first smart card foil 21 there may be subdivision 15. The thus constructed chip module is inserted into corresponding cavity 24 of smart card 20 and glued all round with suitable adhesive 25.

Figures 10 and 11 show different laminating methods wherein chip 10 is disposed between two smart card foils 21 and 22 in smart card 20. Smart card foils 21, 22 characteristically have a thickness of 100 - 300 microns. In the method according to Figure 10a, chip 10 is applied to smart card foil 21 and conductive paths 11 are

located on other smart card foil 22. Chip 10 is applied with its backside to smart card foil 21. The two smart card foils are then positioned one on the other so as to fit, and laminated together, so that chip 10 is contacted by conductive paths 11 (Fig. 10b).

In the method according to Fig. 11a, conductive paths 11 are first applied to one smart card foil 21. On conductive paths 11 chip 10 is then mounted with its front side downward so that contacting simultaneously takes place. Second smart card foil 22 is then laminated thereover (Fig. 11b).

The conductive paths lead in each case to an external contact area or to an interface component which permits contactless data transfer, or they form such a component themselves. To hold chip 10 on first smart card foil 21 until it is covered with second smart card foil 22 during lamination, the surface of first smart card foil 21 can be pretreated by an oxygen or chlorine plasma so that chip 10 adheres bonded thereto until covering and lamination. In the method according to Figs. 11a and 11b the surface can also be printed with a silver conductive paste which simultaneously forms conductive paths 11 so that chip 10 adheres to smart card foil 21 until covering and lamination and is electrically contacted at the same time.

It is of course also possible to apply an adhesive to thinned chip 10 or use an adhesive-coated foil as smart card foil 21. In particular when chips 10 are produced according to the method shown in Figs. 3a and 3b, it is possible to lift chip 10 directly off carrier film 5 by partial solution of the adhesive and glue it with said adhesive to smart card foil 21 where the adhesive can then set again.

Figs. 7, 8 and 9 show a completely novel method wherein the thinned chip is simply mounted on the surface of a smart card and then printed with conductive paths 11. Chip 10 is furthermore coated with protective lacquer 12. For printing conductive paths 11 a screen printing method is preferably used. It is of course also possible to apply conductive paths 11 in the form of a metal foil.

Figs. 12a to 12c show embodiments wherein the conductive paths are first applied to the surface and the chip then placed with the front side downward on terminal areas 11. In Fig. 12b additional lacquer and/or adhesive layer 13 is disposed between integrated circuit 10 and the surface of smart card 20, while in Fig. 12c

chip/conductive path assembly 10, 11 is pressed into the card surface with heated die 14.

In Figs. 8 and 9 thin chip 10 is likewise located directly on the surface of smart card 20, but in small cavity 27. Cavity 27 is either embossed or milled into smart card 20 or already injection molded during production of smart card 20 (Fig. 8). Alternatively, cavity 27 is produced by corresponding printing with protective lacquer 26 or by mounting a protective foil with a window (Fig. 9).

Corresponding assemblies wherein contact areas 11 are first disposed in the gaps of the surface of smart card 20, on which chip 10 is then placed, are shown in Figs. 13a to 13c.

In the example shown in Fig. 13c, the chip is pressed into the surface of smart card 20 flush under the action of heat. In an embodiment according to Fig. 7 (terminal areas 11 not yet present) the foil with the chip flush on the surface can be for example printed with silver paste, coated and possibly contacted at the same time.

All these latter examples of incorporation, with a chip exposed on the surface of the smart card, involve a novel and especially advantageous structure which can be produced with relatively few method steps compared to conventional methods.

Patent claims

1. A method for handling thinned chips (10) for incorporation in smart cards (20) comprising the following method steps:
   - gluing a wafer (1) with its front side to a carrier substrate (4) by means of an adhesive layer (3),
   - thinning the wafer (1) from the backside,
   - dividing the wafer (1) into individual chips (10) by sawing the wafer (1) from the backside up to or into the adhesive layer (3) or into the carrier substrate (4),
   - dissolving the adhesive layer (3),
   - lifting the individual chips (10) off the carrier substrate (4) with a suction head (30) for deposit in a special tray (40) and/or for further processing.
2. A method for handling thinned chips (10) for incorporation in smart cards (20) comprising the following method steps:
   - gluing a wafer (1) with its front side to a carrier substrate (4) by means of an adhesive layer (3),
   - thinning the wafer (1) from the backside,
   - dividing the wafer (1) into individual chips (10) by sawing the wafer (1) from the backside up to or into the adhesive layer (3) or into the carrier substrate (4),
   - gluing the chips (10) sawed out of the wafer (1) on their backsides with a continuous carrier film (5) by means of a second adhesive layer (6),
   - dissolving the first adhesive layer (3) with a method which does not attack the second adhesive layer (6),
   - lifting the chips (10) joined by the carrier film (5) off the carrier substrate (4) together with the carrier film (5),
   - dissolving the second adhesive layer (6) and lifting the individual chips (10) off the carrier film (5).
3. A method for handling thinned chips (10) for incorporation in smart cards (20) comprising the following method steps:

- gluing a wafer (1) with its front side to a carrier substrate (4) by means of an adhesive layer (3),
- thinning the wafer (1) from the backside,
- gluing the wafer (1) on the backside with a continuous carrier film (5) by means of a second adhesive layer (6),
- dividing the wafer (1) into individual chips (10) by sawing the wafer (1) with the glued-on carrier film (5) from the backside of the wafer (1) up to or into the first adhesive layer (3) or into the carrier substrate (4),
- dissolving the first adhesive layer (3) with a method which does not attack the second adhesive layer (6),
- lifting the individual chips (10) off the carrier substrate (4) together with the carrier film (5).

4. A method according to either of claims 2 and 3, characterized in that the first adhesive layer (3) consists of an adhesive which is decomposed under the action of light of a certain wave range, and the second adhesive layer (6) consists of an adhesive which cures under the action of said light.

5. A method according to either of claims 2 and 3, characterized in that the first adhesive layer (3) consists of an adhesive which is decomposed under the action of heat, and the second adhesive layer (6) consists of an adhesive which cures under the action of heat.

6. A method according to either of claims 2 and 3, characterized in that the first adhesive layer (3) consists of a water-soluble adhesive and/or the second adhesive layer (6) consists of an adhesive which is solvent-resistant.

7. A method according to either of claims 2 and 3, characterized in that the first adhesive layer (3) consists of an adhesive which is decomposed under an oxygen plasma or in a certain gas environment, and the second adhesive layer (6) consists of an adhesive which is resistant to said conditions.

8. A method according to any of claims 1 to 7, characterized in that the carrier substrate (4) is dissolved together with the adhesive layer (3) between the wafer (1) and the carrier substrate (4) and/or instead of said adhesive layer (3).

9. A method according to claim 8, characterized in that the carrier substrate (4) consists of a material which decomposes in a plasma and/or under the action of gas and/or under elevated temperature and/or is water-soluble.
10. A method according to any of claims 1 to 9, characterized in that position marks (8) are applied to the backside of the chips (10) and/or of the carrier film (5).
11. A method according to any of claims 1 to 10, characterized in that the chips (10) are applied with their front sides to a first smart card foil (21) provided with conductive paths (11).
12. A method according to any of claims 1 to 10, characterized in that the chips (10) are applied with their backsides to a first smart card foil (21) and contacted with conductive paths (11).
13. A method according to claim 11 or 12, characterized in that the first smart card foil (21) is provided on the surface opposite the chip (10) with contact areas (23) connected with the chip (10) via the conductive paths (11), and the thus constructed chip module is incorporated with the contact areas (23) outside into a cavity (24) of a smart card (20).
14. A method according to claim 11 or 12, characterized in that the first smart card foil (21) with the chip (10) is covered with a second smart card foil (22) and the two smart card foils (21, 22) are laminated together.
15. A method according to claim 14, characterized in that the first smart card foil (21) is pretreated so that the chip (10) adheres to the first smart card foil (21) until it is covered with the second smart card foil (22).
16. A method according to claim 15, characterized in that the first smart card foil (21) is printed with an adhesive conductive paste so that the chip (10) adheres to the first smart card foil (21) until it is covered with the second smart card foil (22), and is electrically contacted at the same time.
17. A method according to any of claims 1 to 10, characterized in that the chips (10) are applied with their backsides to a first smart card foil (21) and the first smart card foil (21) with the chip (10) is covered with a second smart card foil

(22) provided with conductive paths (11) at the corresponding positions, and the two smart card foils (21, 22) are laminated together.

18. A method for incorporating a thinned chip (10) into a smart card (20), in particular according to any of claims 1 to 10, characterized in that the chip (10) is applied to a surface of the smart card (20) externally.

19. A method according to claim 18, characterized in that the chip (10) is applied with its front side pointing outside to the surface of the smart card (20) and provided with conductive paths (11).

20. A method according to claim 18 or 19, characterized in that the chip (10) is incorporated into a cavity (27) in the surface of the smart card (20).

21. A method according to any of claims 18 to 20, characterized in that the chip (10) is pressed into the surface of the smart card (20) flush under the action of heat.

22. A method according to any of claims 18 to 21, characterized in that the chip (10) located on the surface of the smart card (20) is coated with a protective lacquer (12).

23. A method according to any of claims 11 to 22, characterized in that the conductive paths (11) are applied by means of a printing or embossing method.

24. A method according to claim 2 and any of claims 12 to 23, characterized in that the chip (10) is lifted off the carrier film (5) and mounted on the smart card foil (21) or the surface of the smart card (20).

25. A method according to claim 24, characterized in that the chip (10) is glued onto the card foil (20) by means of the adhesive of the dissolved second adhesive layer (6).

26. A method according to claim 25, characterized in that the chip (10) is lifted off the carrier foil (5) with a suction head (30) and applied to the card foil (20), the second adhesive layer (6) being dissolved under the action of heat.

27. A smart card (20) with at least one thinned chip (10) which is disposed on a surface of the smart card (20).

28. A smart card according to claim 27, characterized in that the chip (10) is disposed with its front side outside on the smart card (20) and conductive paths (11) are applied to the smart card (20) and the chip (10) on the outside.
29. A smart card according to claim 27 or 28, characterized in that the conductive paths (11) are printed.
30. A smart card according to any of claims 27 to 29, characterized in that the chip (10) is disposed in a cavity (27) in the surface of the smart card (20).
31. A smart card according to any of claims 27 to 30, characterized in that the chip (10) is pressed into the surface of the smart card (20) flush.
32. A smart card according to any of claims 27 to 31, characterized in that the chip (10) is coated with a protective lacquer (12).

Abstract

Methods are described for handling thinned chips for incorporation in smart cards. A wafer is in each case first glued with its front side to a carrier substrate by means of an adhesive layer. Then the wafer is thinned from the backside and divided into individual chips by sawing from the backside up to the adhesive layer. The adhesive layer is then dissolved and the individual chips lifted off the carrier substrate with a suction head and deposited in a special tray for further processing. Alternatively, the chips sawed out of the wafer are glued on the backside with a continuous carrier film by means of a second adhesive layer and the first adhesive layer then dissolved with a method which does not attack the second adhesive layer. The chips joined by the carrier film can thus be lifted off the carrier substrate together and removed individually from the carrier film after dissolution of the second adhesive layer. The wafer can alternatively be glued on the backside with a continuous carrier film by means of a second adhesive layer before sawing. In this case, too, the first adhesive layer is dissolved while retaining the second adhesive layer, and the individual chips reinforced by the carrier film are then lifted off the carrier substrate.

FIG. 1

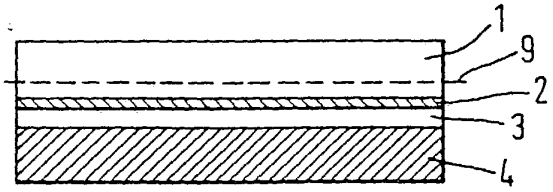


FIG. 2a

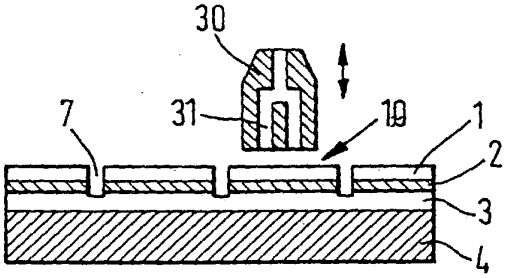


FIG. 2b

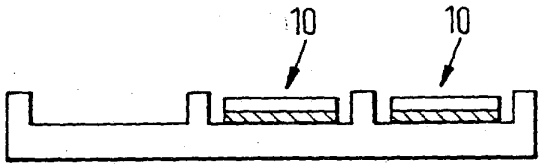


FIG. 3a

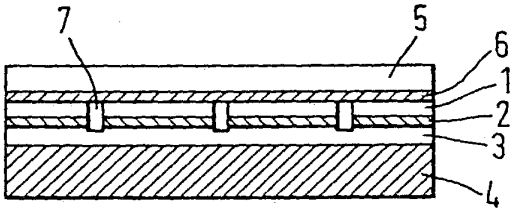


FIG. 3b

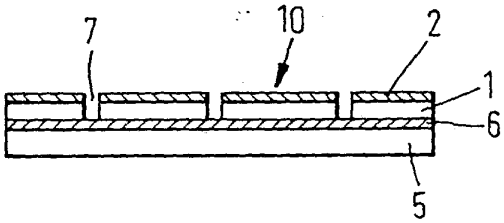


FIG. 4a

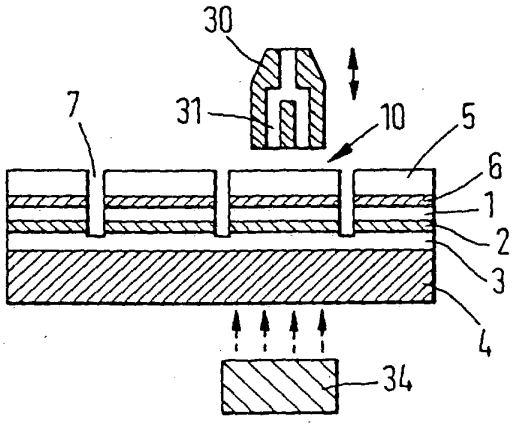


FIG. 4b

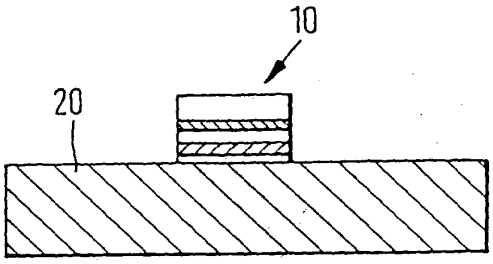


FIG. 5

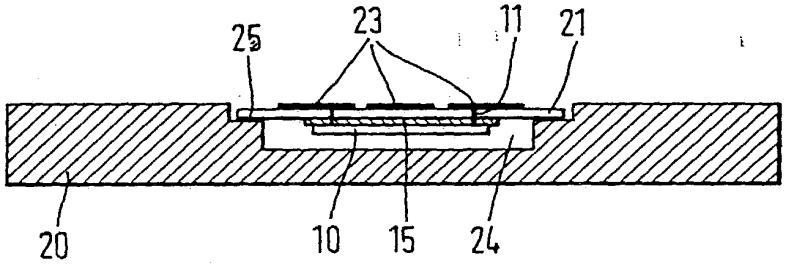


FIG. 6

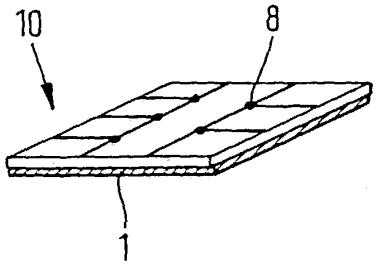


FIG. 7

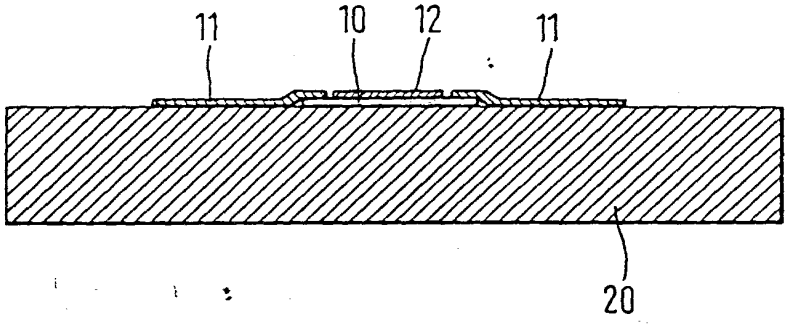


FIG. 8

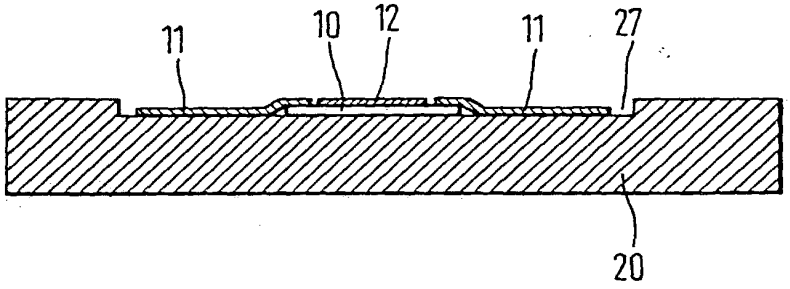


FIG. 9

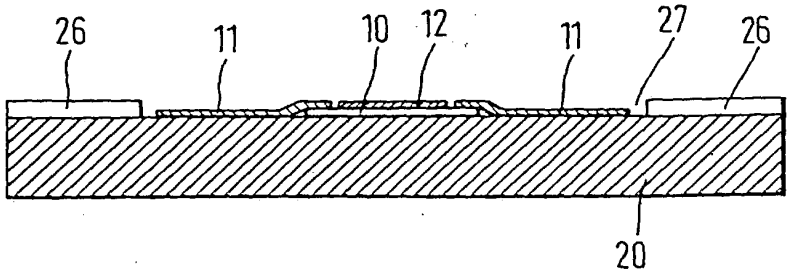


FIG. 10a

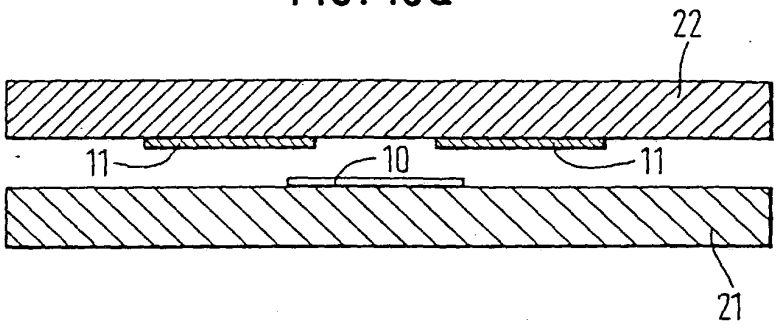


FIG. 10b

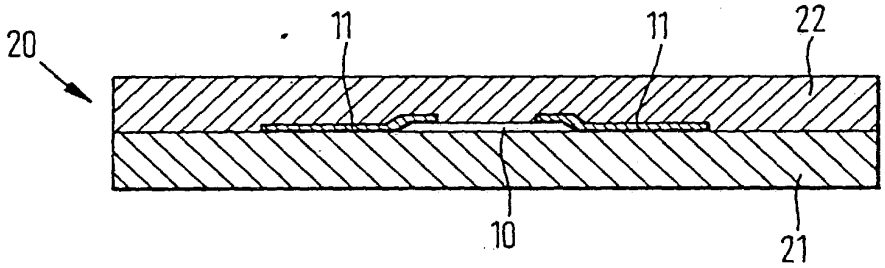


FIG. 11a

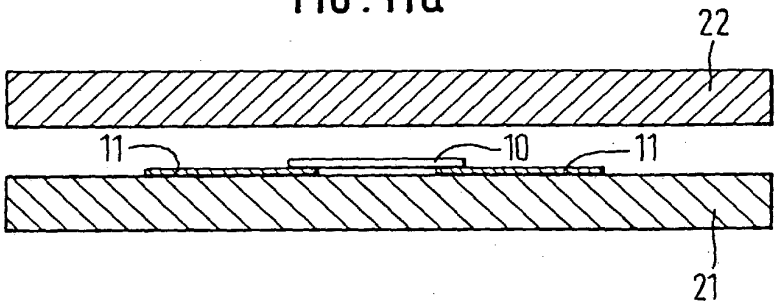


FIG. 11b

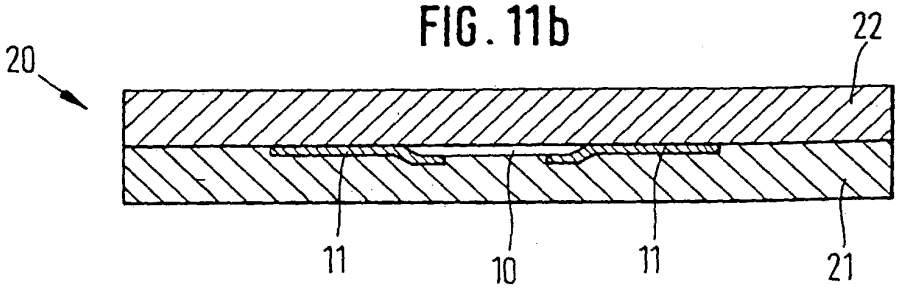


FIG. 12a

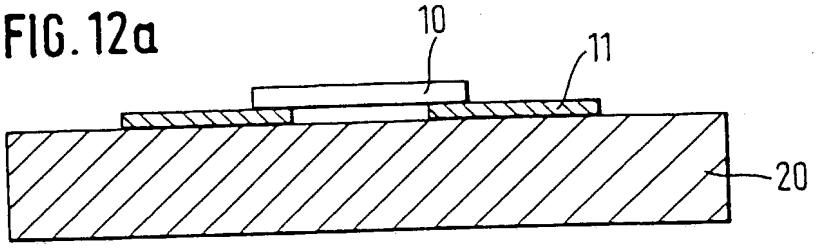


FIG. 12b

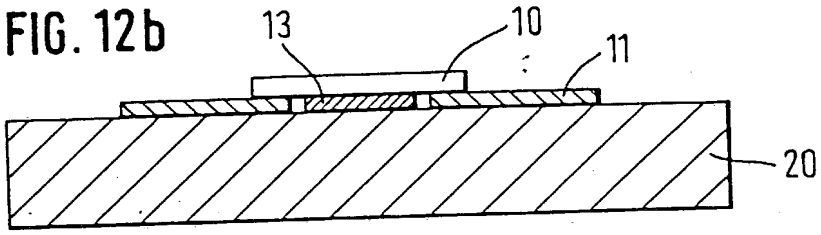


FIG. 12c

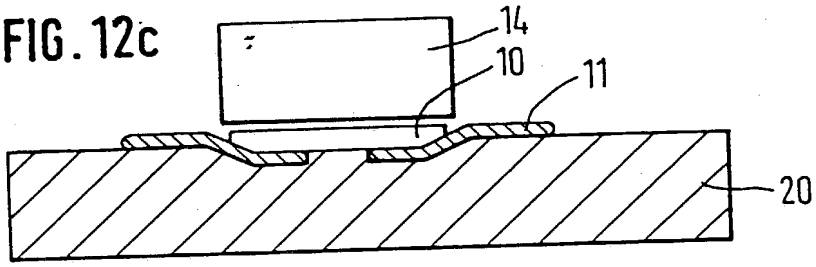


FIG. 13a

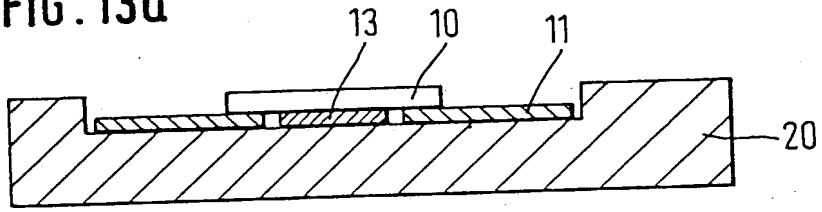


FIG. 13b

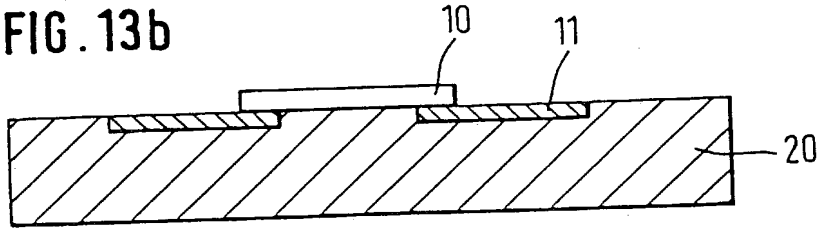
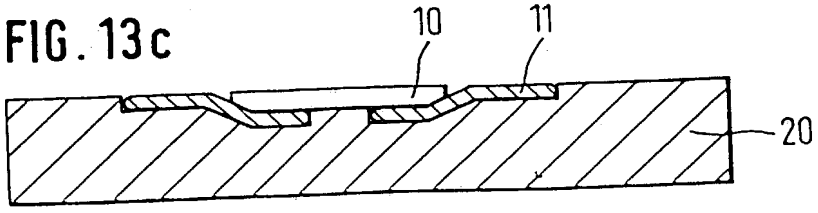


FIG. 13c



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ATTORNEY/DOCKET NO: GRAS3004/JEK

DECLARATION FOR PATENT APPLICATION AND APPOINTMENT OF ATTORNEY

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name; I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention (Design, if applicable) entitled:

METHOD FOR HANDLING THINNED CHIPS FOR INTRODUCING THEM INTO CHIP CARDS

the specification of which (check one):

☐ is attached hereto, or ☒ was filed on: **04 May 2000** as U.S. Application Number or PCT International Application Number: **(PCT/EP00/03988) 09/926,447** and (if applicable) was amended on:

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment(s) referred to above. I acknowledge the duty to disclose information which is material to patentability as defined in *Title 37, Code of Federal Regulations, §1.56*. I hereby claim foreign priority benefits under *Title 35, United States Code §119* of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

PRIOR FOREIGN APPLICATION(S)			PRIORITY CLAIMED	
Number	Country	Day/Month/Year Filed	Yes	No
199 21 230.9	Germany	07 May 1999	X	

☐ Additional Priority Application(s) Listed on Following Page(s)

I HEREBY CLAIM THE BENEFIT UNDER TITLE 35 U.S. CODE §119(E) OF ANY U.S. PROVISIONAL APPLICATIONS LISTED BELOW.	
Application Number	Day/Month/Year Filed

☐ Additional Provisional Application(s) Listed on Following Page(s)

I hereby claim the benefit under *Title 35, United States Code, §120* of any United States application(s) or PCT international application(s) designating The United States of America listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of *Title 35, United States Code, §112*, I acknowledge the duty to disclose information which is material to patentability as defined in *Title 37, Code of Federal Regulations, §1.56* which became available between the filing date of the prior application(s) and the national or PCT international filing date of this application:

Application Number	Filing Date	Status - Patented, Pending or Abandoned

☐ Additional US/PCT Priority Application(s) listed on Following Page(s)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under *section 1001 of title 18 of the United States Code* and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: I (We) hereby appoint as my (our) attorneys, with full powers of substitution and revocation, to prosecute this application and transact all business in the Patent and Trademark Office connected therewith: J. Ernest Kenney, Reg. No. 19,179; Eugene Mar, Reg. No. 25,893; Richard E. Fichter, Reg. No. 26,382; Thomas J. Moore, Reg. No. 28,974; Joseph DeBenedictis, Reg. No. 28,502; Benjamin E. Urcia, Reg. No. 33,805; and

I(we) authorize my(our) attorneys to accept and follow instructions from **Klunker Schmitt-Nilson Hirsch** regarding any matter related to the preparation, examination, grant and maintenance of this application, any continuation, continuation-in-part or divisional based thereon, and any patent resulting therefrom, until I(we) or my(our) assigns withdraw this authorization in writing.

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DATE 25.02.2002	SIGNATURE X

☒ *See following page(s) for additional joint inventors.*

CONTINUATION OF DECLARATION FOR PATENT APPLICATION AND APPOINTMENT OF ATTORNEY

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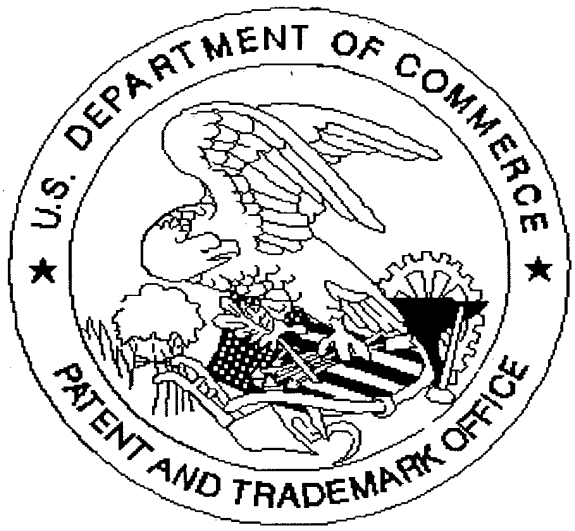

Application deficiencies found during scanning:

☑ Page(s) #2 of Declaration were not present for scanning.
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